

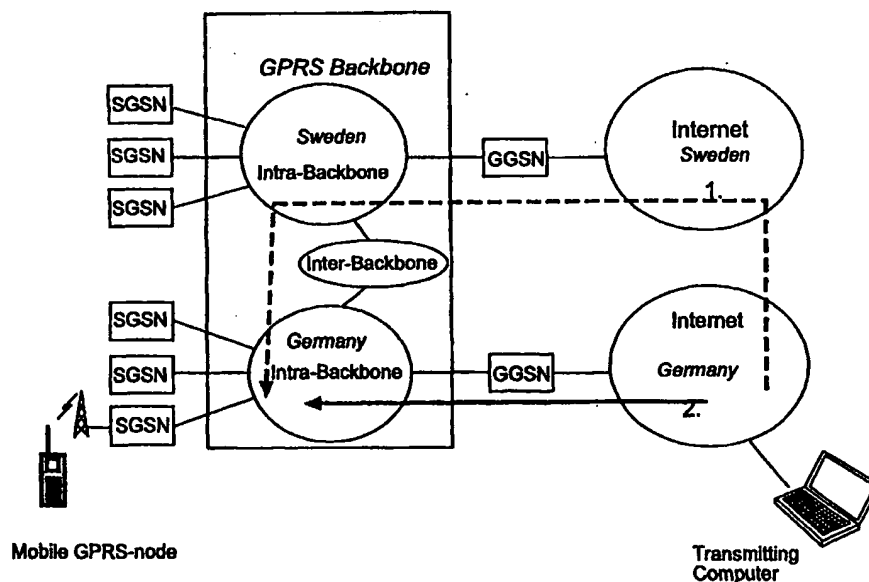


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(54) Title: PROCEDURE TO OBTAIN A COMMUNICATION ROUTE BETWEEN A TRANSMITTING COMPUTER AND A MOBILE GPRS-NODE VIA GGSN



## (57) Abstract

Procedure at a digital communication network to obtain a communication route for IP-packets between a transmitting computer and a mobile GPRS-node via GGSN (Gateway GPRS Support Node). An SGSN (Service GPRS Support Node) where the mobile GPRS-node at the moment is, decides that if the IP-packets it receives are not tunnelled by GTP (GPRS Tunneling Protocol) from an optimal GGSN, then an optimal GGSN shall be selected.

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PROCEDURE TO OBTAIN A COMMUNICATION ROUTE BETWEEN A TRANSMITTING COMPUTER AND A MOBILE  
GPRS-NODE VIA GGSN

TECHNICAL FIELD

The present invention relates to a procedure at a digital  
5 communications network to obtain a communication route for  
IP-packets between a transmitting computer and mobile GPRS-  
node via GGSN (Gateway GPRS Support Node).

PRIOR ART

10 GPRS is a new telecommunications service which is  
especially adapted to digital cellular networks (GSM, DECT,  
PCS). GPRS makes use of the packet radio principle and can  
be used to transfer data via for instance the protocols IP  
and X.25 from/to a GPRS-terminal and from/to other GPRS-  
15 terminals and/or external packet data networks. GPRS is  
standardised in ETSI (European Telecommunication  
Standardisation Institute). GPRS makes use of a packet data  
technique to transmit high speed data and low speed data in  
an efficient way over GSM radio networks. GPRS optimises  
20 the use of network resources and radio resources. A strict  
separation of the radio subsystems and the network  
subsystems is obtained which results in that the network  
subsystems can be reused by other radio access  
technologies. GPRS does not require changes in the  
25 installed MSC base stations.

GPRS consequently is a packet switched data service which  
gives a mobile high speed transmission of data with  
efficient use of the existing bandwidth. This is a new  
30 technology in the field of GSM telephony which in optimal  
cases can cope with transmission rates up to 200 kb/s (as  
compared with 9,6 kb/s which GSM can cope with today). Data  
transmission via GSM can be realised in two different ways:  
circuit switched as in the voice transmissions of today  
35 (HSCSD) or packet switched as in GPRS.

## TECHNICAL PROBLEM

GPRS (General Packet Radio Service) gives a computer in global Internet the possibility to address a mobile GPRS-node with a static IP-address. The use of static IP-addresses makes it possible for a computer in global Internet to initiate a session. By standard IP-routing the IP-packets which are addressed to the static IP-address of the mobile GPRS-node to be routed to the GGSN (Gateway GPRS Support Node) which has the static IP-address in its address space. From GGSN then the IP-packets are tunnelled by GTP to the SGSN (Serving GPRS Support Node) where the mobile GPRS-node at the moment is: after that the IP-packets are transmitted to the mobile GPRS-node. This routing, however, has a number of disadvantages which the present invention can eliminate. The invention gives an optimal routing, i.e. IP-packets which are transmitted from a computer in the global Internet will be tunnelled by GTP in optimal route through GPRS backbone. The invention also solves the problems which can arise with bottle-necks both in Internet and GPRS Backbone when all traffic addressed to a node is forwarded through the same point (GGSN).

## TECHNICAL SOLUTION

The technical solution is described in what is stated in the patent claims.

## ADVANTAGES

By the present invention the public telecommunications network will be improved.

30

The invention is intended to be used in connection with GPRS and will by that be usable for both GSM and future mobile telephone systems as well as Internet.

35 The invention results in a better utilisation of existing network resources and by that more stable transmission

times between transmitting and receiving units by a more optimal routing in the Internet. Further the invention aims at optimising the route through GPRS-backbone. The invention also gives the system better performance and a  
5 more stable performance.

#### DESCRIPTION OF FIGURES

Figure 1 shows a schematic drawing of the system solution according to the invention.

10

#### DESCRIPTION

A list of the used abbreviations is shown below to facilitate the understanding of the invention.

15

BSS            Base Sub System

CN            Core Network

20    ETSI            European Telecommunication  
Standardisation Institute

GGSN           Gateway GPRS Support Node

25    GPRS           General Packet Radio Service

GTP           GPRS Tunnelling Protocol

GSM           Global System for Mobile Communication

30

HLR           Home Location Register

IP            Internet Protocol

35    MS            Mobile Station

MSC            Mobile Services Switching Centre

PLMN           Public Land Mobile Network

5    SGSN           Service GPRS Support Node

Figure 1 describes a system where a transmitting computer in global Internet transmits IP-packets to a mobile GPRS-node which is in a GPRS-network. Reference designation 1  
10 shows the route according to known technology, and reference designation 2 shows the route according to the invention.

GPRS introduces two new network nodes in the PLMN of the  
15 GSM. It is the Serving GPRS Support Node (SGSN), which is on the same hierarchical level as MSC and which checks the individual MSs as to position and performs security functions and access control. SGSN can be connected to the base stations by Frame Relay.

20 Gateway GSN (GGSN) gives possibility to co-operate with external packet switched networks and is connected with SGSNs via IP-based GPRS backbone network. HLR is equipped with GPRS subscriber information and SMS-MSCs are upgraded to support SMS transmission via SGSN.

25 The security functionality of GPRSs is equivalent to the existing GSM. SGSN executes authentication and coding procedures based on the same algorithms, keys and other criteria as in the existing GSM. In order to transmit and receive GPRS-data, MS shall activate the packet data  
30 address which it wants to use. This results in that MS will be known in the belonging GGSN and co-operation with external data networks can start.

User data are transferred transparently between MS and external data networks by a method known as "encapsulation"  
35 and "tunnelling": the data packets are equipped with GPRS-

specific protocol information and are transferred between MS and GGSN.

When the mobile GPRS-node has a static IP-address which  
5 belongs to the address space in GGSN in Sweden and at the moment is in an Intra-backbone in Germany, the following will happen at communication between transmitting computer and mobile GPRS-node.

IP-packets which are transmitted from a computer in the  
10 global Internet in Germany to the static IP-address of the mobile GPRS-node will be routed to the GGSN of the mobile GPRS-node in Sweden and then tunnelled by GTP through GPRS backbone to SGSN in Germany according to the at present established technology.

15 The dashed line (1) shows the normal route which IP-packets are routed from a transmitting computer in Germany to a mobile GPRS-node in Germany. As will be evident from the Figure, this transport is not very good because the transport distance will be long. This then is an example of  
20 the routing path which IP-packets are routed according to the technology of today.

By implementing a function in SGSN which implies that the packets are routed according to a procedure which means that if the SGSN where the mobile GPRS-node at the moment  
25 is decides that IP-packets which it receives are not tunnelled by GTP from an optimal GGSN, an optimal GGSN shall be selected.

Below follows a detailed description of the procedure:

- 30 1. In SGSN there is a list over which GGSNs that are suitable to communicate with. When SGSN receives an IP-packet which is tunnelled by GTP from normal GGSN, SGSN inquires whether there is any optimal GGSN. Selection of optimal GGSN is based on from where the IP-packets are  
35 transmitted, i.e. the transmitter address in the head of the IP-packet, and the list over GGSNs which are

suitable to communicate with. An optimal GGSN is selected.

2. A message is transmitted to optimal GGSN with the content to create an association between the static IP-address of the mobile GPRS-node and the SGSN where the mobile GPRS-node at the moment is. The result will be that IP-packets addressed to the static IP-address of the mobile GPRS-node which are received at optimal GGSN will be tunnelled by GTP to the temporary SGSN.
3. SGSN awaits a confirmation from optimal GGSN that an association is created between the static IP-address of the mobile GPRS-node and the temporary SGSN.
4. Optimal GGSN transmits a confirmation to SGSN that an association is created between the static IP-address of the mobile GPRS-node and the temporary SGSN.
5. SGSN after that transmits a message to the transmitting computer in global Internet with the content that IP-packets addressed to the static IP-address of the mobile GPRS-node shall be encapsulated and tunnelled to the to the IP-address belonging optimal GGSN.
6. IP-packets addressed to the static IP-address of the mobile GPRS-node now will be tunnelled to optimal GGSN where the IP-packet is decapsulated, i.e. IP-packets will regain their original form. After that the IP-packets are tunnelled by GTP to the SGSN where the mobile GPRS-node at the moment is.
7. If the mobile GPRS-node changes SGSN while the session is in progress, the association is updated in optimal GGSN with the new SGSN. IP-packets which already have been transmitted to the previous SGSN are transmitted from the old SGSN to the new SGSN.

In the transmitting computer there is support for encapsulation of IP-packets, and support to manage associations between the static IP-address of the mobile GPRS-node and optimal GGSN. In GGSN there is support for



decapsulation of IP-packets and support to manage associations between the static IP-address of the mobile GPRS-node and the temporary SGSN.

- 5 The association between the normal GGSN and the temporary SGSN is updated all the time to make it possible for other users to start new sessions. If the transmitting computer does not have support for encapsulation of IP-packets, or does not have support to manage associations between the  
10 static IP-address of the mobile GPRS-node and optimal GGSN, the normal route always can be used.

The continuous line (2) shows the optimal route which is achieved by use of the procedure according to the  
15 invention, at which IP-packets are routed from a transmitting computer in Germany to a mobile GPRS-node in Germany.

The invention is not limited to the above illustrated  
20 example, but can be modified within the idea of the invention as it is defined in the patent claims..

## PATENT CLAIMS

1. Procedure at a digital communication network to obtain a communication route for IP-packets between a transmitting  
5 computer and mobile GPRS-node via GGSN (Gateway GPRS Support Node), characterised in that an SGSN (Service GPRS Support Node), where the mobile GPRS-node at the moment is, decides that if IP-packets it receives are not tunnelled by GTP (GPRS Tunnelling Protocol) from  
10 an optimal GGSN, then an optimal GGSN shall be selected.
2. Procedure according to patent claim 1,  
characterised in that the decision is made  
via a device in SGSN which includes a function to route  
15 IP-packets.
3. Procedure according to patent claim 2,  
characterised in that in SGSN there is  
information about which GGSNs that are suitable to  
20 communicate with, and when SGSN receives an IP-packet which is tunnelled by GTP from the normal GGSN, then SGSN  
inquires if there is any optimal GGSN, at which optimal  
GGSN is based on from where the IP-packets are transmitted,  
i.e. the transmitter address in the head of the IP-packet,  
25 and the information over GGSNs which are suitable to  
communicate with, at which an optimal GGSN is selected.
4. Procedure according to patent claim 3,  
characterised in that a message is transmitted  
30 to optimal GGSN with the content to create an association  
between the static IP-address of the mobile GPRS-node and  
the SGSN where the mobile GPRS-node at the moment is, at  
which IP-packets addressed to the static IP-address of the  
mobile GPRS-node which are received at optimal GGSN will be  
35 tunnelled by GTP to the temporary SGSN.

5. Procedure according to patent claim 4,  
c h a r a c t e r i s e d in that SGSN awaits a  
confirmation from optimal GGSN that an association is  
created between the static IP-address of the mobile GPRS-  
5 node and the temporary SGSN.
6. Procedure according to patent claim 5,  
c h a r a c t e r i s e d in that optimal GGSN transmits a  
confirmation to SGSN that an association is created between  
10 the static IP-address of the mobile GPRS-node and the  
temporary SGSN.
7. Procedure according to patent claim 6,  
c h a r a c t e r i s e d in that SGSN transmits a message  
15 to the transmitting computer in global Internet with the  
content that IP-packets addressed to the static IP-address  
of the mobile GPRS-node shall be encapsulated and tunnelled  
to, to the IP-address belonging, optimal GGSN.
- 20 8. Procedure according to patent claim 7,  
c h a r a c t e r i s e d in that if the mobile GPRS-node  
changes SGSN during session in progress, the association is  
updated in optimal GGSN with the new SGSN at which IP-  
packets which already have been transmitted to the previous  
25 SGSN are transmitted from the old SGSN to the new SGSN.
9. Procedure according to patent claim 8,  
c h a r a c t e r i s e d in that in the transmitting  
computer there is support for encapsulation of IP-packets,  
30 and support to manage associations between the static IP-  
address of the mobile GPRS-node and optimal GGSN, and in  
GGSN there is support for decapsulation of IP-packets and  
support to manage associations between the static IP-  
address of the mobile GPRS-node and the temporary SGSN.

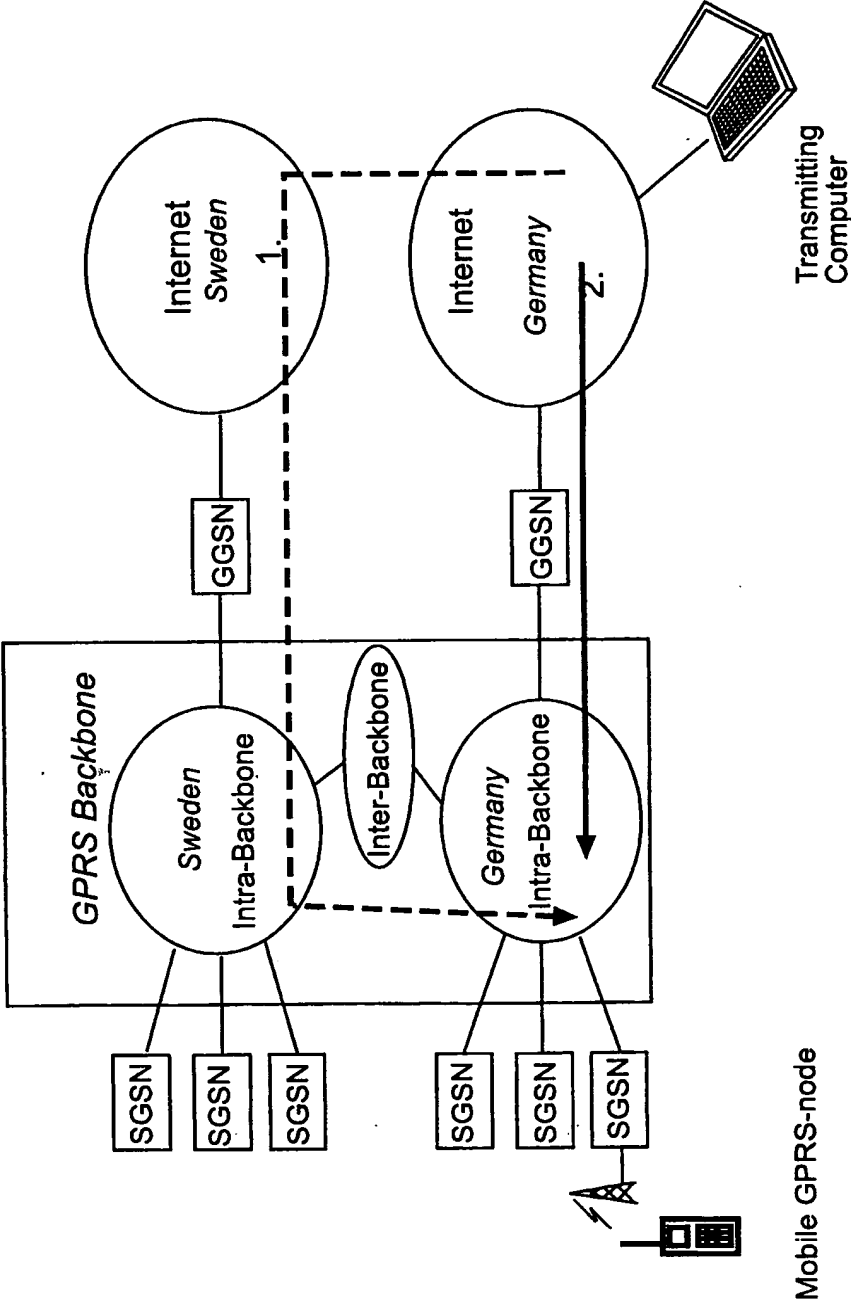


Figure 1

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/01547

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/22

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## B. FIELDS SEARCHED

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IPC7: H04Q, H04L

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9748246 A1 (TELEFONAKTIEBOLAGET LM ERICSSON (PUBL)), 18 December 1997 (18.12.97), page 6, line 15 - page 8, line 18 --	1-9
P,A	WO 9859468 A2 (NOKIA TELECOMMUNICATIONS OY), 30 December 1998 (30.12.98), page 6, line 7 - line 22 --	1-9
A	IEEE Communications Magazine, Volume, August 1997, Götz Brasche et al, "Concepts, Services, and Protocols of the New GSM Phase 2+ General Packet Radio Service" page 97 - page 98 --	1-9



Further documents are listed in the continuation of Box C.



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International application No.

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## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0859531 A2 (TELEFONAKTIEBOLAGET LM ERICSSON), 2 January 1998 (02.01.98), abstract  ---	1
A	US 5325362 A (ASHAR AZIZ), 28 June 1994 (28.06.94), abstract  -----	1

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

02/12/99

PCT/SE 99/01547

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9748246 A1	18/12/97	AU 3199797 A CA 2257981 A CN 1228228 A EP 0904665 A US 5708655 A	07/01/98 18/12/97 08/09/99 31/03/99 13/01/98
WO 9859468 A2	30/12/98	AU 7920998 A EP 0920761 A FI 972725 A	04/01/99 09/06/99 25/12/98
EP 0859531 A2	02/01/98	AU 6225898 A NO 970181 A WO 9832305 A ZA 9800074 A	07/08/98 16/07/98 23/07/98 08/07/98
US 5325362 A	28/06/94	EP 0655847 A JP 7170286 A	31/05/95 04/07/95

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